

Biogas to Vehicle Fuel Demonstration Project

Dane County, WI

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Demonstration Project Background

- ▶ **Joint venture between private, public and educational agencies**
- ▶ **Started as an idea. How is this done and can we do it here in Wisconsin?**
- ▶ **Project has generated much interest:**
 - **USEPA, USDA, Private Waste Industries, Municipalities**
- ▶ **First viable small biogas to CNG system**
20 scfm = 100 gallons of gasoline /day

Demonstration Project Partners

- ▶ **Dane County Public Works**
- ▶ **Alliant Energy**
- ▶ **Madison Area Technical College**
- ▶ **ANGI Energy Systems**
- ▶ **Unison Solutions**
- ▶ **Cornerstone Environmental Group**



Dane County, WI Biogas Fueling Station

Natural Gas Vehicles

- ▶ Over 10 million NGVs in use worldwide, 110K in US, 1 in 5 busses ordered are NG
- ▶ Operating and maintenance cost are lower than Gasoline/Diesel
- ▶ NG vehicles have less emissions than diesel or gasoline
- ▶ Less greenhouse gas emissions



Example Natural Gas Vehicles

Biogas to CNG Treatment Requirements

- ▶ Moisture removal
- ▶ Hydrogen Sulfide removal
- ▶ VOC removal
- ▶ CO₂ removal
- ▶ Fuel requirements, SAE J1616

Cornerstone /Unison Biogas Cleanup System

► Inlet Conditions of biogas

- CH₄ 50 to 60%
- CO₂ 40 to 50 %
- H₂S < 1,500 ppmv
- Siloxane < 1,500 ppmv

► CNG Outlet Gas (SAE J1616)

- CH₄ 94 to 98%
- CO₂ 0.5 to 2.0 %
- H₂S Non Detect
- Siloxane Non Detect
- H₂O < - 40 F dew point
- 100 to 400 Gallons of Gasoline Equivalent (GGE) Fuel/day

Gasoline Gallon Equivalent Pricing of Vehicle Fuel

Gasoline Gallon Equivalent Costs Updated April, 2010

| Fuel Type | Unit | Btu/Unit | GGE | Unit Cost | GGE Cost |
|-------------------------------|------|----------|------|-----------|----------|
| Regular Unleaded Gasoline | gal | 116090 | 1.00 | \$2.83 | \$2.83 |
| Highway Diesel Fuel | gal | 129800 | 0.89 | \$3.02 | \$2.69 |
| Natural Gas | c.f. | 1028 | 113 | \$0.0041 | \$0.46 |
| Compressed Natural Gas (CNG) | GGE | NA | 1.00 | \$1.85 | \$1.85 |
| Wholesale Propane (LPG) | gal | 84950 | 1.37 | \$1.24 | \$1.70 |
| Residential Propane (LPG) | gal | 84950 | 1.37 | \$2.62 | \$3.59 |
| E-85 Ethanol/Gasoline Mixture | gal | 82290 | 1.41 | \$2.33 | \$3.29 |
| Biodiesel (B-20) | gal | 119550 | 0.97 | \$2.96 | \$2.87 |

Unit Cost Information Based on Data From the USDOE

Project Economics

- ▶ 100 GGE/day replacing Gasoline at \$2.85/gal
= \$95,000 / year avoided cost
- ▶ As Demand for CNG increases natural gas can be blended with biomethane at 10% resulting in 1000 GGE/day
- ▶ Approximate System Cost
 - \$300,000 for gas conditioning skid
 - \$55,000 for CNG time fill station
 - \$50,000 for installation and permitting

Contact Information

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